The roof is the crowning glory of a building and often special care is
given to their appearance. Each style period does have its own distinct-
tive roof or facade designs. For example, the Gothic architecture has
steep roofs, steeples and towers that transform a relatively nondescript
building to striking homes, churches or cathedrals. The roof is the
crowning glory of a building and often special care is
given to their appearance. Each style period does have its own distinct-
tive roof or facade designs. For example, the Gothic architecture has
steep roofs, steeples and towers that transform a relatively nondescript
building to striking homes, churches or cathedrals. The roof is the
crowning glory of a building and often special care is
given to their appearance. Each style period does have its own distinct-
tive roof or facade designs. For example, the Gothic architecture has
steep roofs, steeples and towers that transform a relatively nondescript
building to striking homes, churches or cathedrals.

PV as art: integration of roof-mounted solar energy and
daylight systems

Choice studio
During my time at the TU Delft I was given the opportunity to study abroad;
one time in la bella Venezia and another time in London. I discovered that
there are several different ways of approaching the architectural field and that
there exists a gap between the more aesthetic and narrative approach of
architecture and the technical method. This ‘grey area’ where architecture
and engineering come together interests me a lot. I believe that this integrati-
on will become more important in the future since the role of an autonomous
architect is changing to an interacting architect/entrepreneur.

PROBLEM STATEMENT

The roof is the crowning glory of a building and often special care is
given to their appearance. Each style period does have its own distinct-
tive roof or facade designs. For example, the Gothic architecture has
steep roofs, steeples and towers that transform a relatively nondescript
building to striking homes, churches or cathedrals. The roof is the
crowning glory of a building and often special care is
given to their appearance. Each style period does have its own distinct-
tive roof or facade designs. For example, the Gothic architecture has
steep roofs, steeples and towers that transform a relatively nondescript
building to striking homes, churches or cathedrals. The roof is the
crowning glory of a building and often special care is
given to their appearance. Each style period does have its own distinct-
tive roof or facade designs. For example, the Gothic architecture has
steep roofs, steeples and towers that transform a relatively nondescript
building to striking homes, churches or cathedrals.

PV as art: integration of roof-mounted solar energy and
daylight systems

Choice studio
During my time at the TU Delft I was given the opportunity to study abroad;
one time in la bella Venezia and another time in London. I discovered that
there are several different ways of approaching the architectural field and that
there exists a gap between the more aesthetic and narrative approach of
architecture and the technical method. This ‘grey area’ where architecture
and engineering come together interests me a lot. I believe that this integrati-
on will become more important in the future since the role of an autonomous
architect is changing to an interacting architect/entrepreneur.

PV as art: integration of roof-mounted solar energy and
daylight systems

Choice studio
During my time at the TU Delft I was given the opportunity to study abroad;
one time in la bella Venezia and another time in London. I discovered that
there are several different ways of approaching the architectural field and that
there exists a gap between the more aesthetic and narrative approach of
architecture and the technical method. This ‘grey area’ where architecture
and engineering come together interests me a lot. I believe that this integrati-
on will become more important in the future since the role of an autonomous
architect is changing to an interacting architect/entrepreneur.

PV as art: integration of roof-mounted solar energy and
daylight systems

Choice studio
During my time at the TU Delft I was given the opportunity to study abroad;
one time in la bella Venezia and another time in London. I discovered that
there are several different ways of approaching the architectural field and that
there exists a gap between the more aesthetic and narrative approach of
architecture and the technical method. This ‘grey area’ where architecture
and engineering come together interests me a lot. I believe that this integrati-
on will become more important in the future since the role of an autonomous
architect is changing to an interacting architect/entrepreneur.
A guiding principle for this innovation is the term eco-efficiency. This sustainable development principle was established by the World Business Council for Sustainable Development (WBCSD) in the 1990s. By them eco-efficiency is defined as "eco-efficiency is achieved by the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life-cycle to a level at least in line with the Earth's estimated carrying capacity." In short, it is concerned with creating more value with less impact or in other words, eco-efficiency encourages low-impact growth.

Focusing this term on the current situation of adding solar panels to the existing building stock, it is important for creating a viable new solution to take into account both pillars of the term eco-efficiency: ecology and economy. The objective is to develop an attractive, adaptable and low costs solar system with both a high energy performance (economy) and as a positive effect for the indoor climate (ecology). Only if the new solar panel system is economically attractive for the existing building stock, it can be realistic. The philosophy of eco-efficiency says that this can be reached by reducing the ecological impact of the solar panels. In that way ecology and economy work together.

The use of tracking systems for the solar panels is an eco-efficient strategy for improving the ecology and economy: potentially lowering both costs and lifecycle environmental impacts per kWh generated. A good sun-tracking system must be reliable and able to track the sun at the right angle even in the periods of cloud cover. An autonomous, natural solar tracker can be cheaper and needs less maintenance due the absence of electrical components than existing solar tracking systems. In other words the integration of a tracking system improves both the solar energy production (more constant) as the indoor daylight qualities (reflecting direct sunlight) (more value) without using significant more material (less impact).

**OVERALL DESIGN QUESTION**
In which aesthetic and eco-efficient way, solar energy and daylight can be integrated in a roof-mounted system, using an existing building on the Marineterrein in Amsterdam as a test subject?

**THEMATIC RESEARCH QUESTION**
How can solar energy and daylight be integrated in a roof-mounted system, by using a low tech solar tracking system?

**RESEARCH METHODS**

<table>
<thead>
<tr>
<th>MSc 3 research</th>
<th>MSc 4 design (+research)</th>
</tr>
</thead>
<tbody>
<tr>
<td>thematic research</td>
<td>integration</td>
</tr>
<tr>
<td>testing &amp; applying</td>
<td></td>
</tr>
</tbody>
</table>

**I. DAYLIGHT**
- What are the advantages and disadvantages of allowing daylight in a building through the roof? (L + V)
- What are good architectural examples for allowing daylight through the roof? (L + V)
- In which way these examples reflect the direct sunlight? (make database) (L + R)

**II. SOLAR ENERGY**
- What are the principles of solar tracking? (L + I)
- Which mechanical systems exist for solar tracking and what are their advantages and disadvantages? (L + I)
- Which active and passive drive systems exist for solar tracking and what are their advantages and disadvantages? (L + I)
- Introduce passive drive tracking system using electromagnetism and magnetic influence (L + I + R)

**III. MARINETERREIN**
- In which way the Marineterrein can contribute to the energy transition (from a central to a decentral/ independent energy system)? (L + I + R)
- Which building on the Marineterrein would suited the best as a test subject? (L + V)
- How is the relevant building constructed and what are the current climate and lighting systems? (L + I + V)
- How is the insolation on the relevant building? (L)
- In which way or pattern panels can be placed on the roof to create a pleasant indoor climate? (make digital and physic models) (D)

**IV. PROTOTYPE**
- Make and test prototype (D)

**V. DESIGN**
- Design and apply the roof system to an existing building on the Marineterrein in Amsterdam (V + D)
I. DAYLIGHT

literature

II. SOLAR ENERGY

literature

interview
Robin Berg of LomboxNet (i.a. the project “Smart Solar Charging”) > innovation
Marc Buiss - previous solar system contractor > commercial

III. ASSEMBLY

literature

interview
Henk Berghede - owner Bouwbedrijf Berghede > reality in building industry